ELEC4250 Robotic Manipulation and Mobility

Course Description

This course provides an overview of the techniques that enable robots to interact with the world, that is, robotic manipulation and locomotion. Fundamental theories and models regarding robotic manipulation and locomotion will be introduced. Hands-on experience involving the development of a robotic software/hardware system will also be provided through term projects and assignments. *Exclusion(s)*: MECH 4000J *Prerequisite(s):* ELEC 3200 OR CENG 3110 OR MECH 3610

List of Topics

Part I Foundations: “how to describe robotic motion” and “how to generate robotic motion”

- Week 1: Configuration space
- Week 2: Rigid body motions
- Week 3: Rigid body motions
- Week 4: Actuators and drive systems

Part II Robotic Manipulation: “how to handle objects with robots”

- Week 5: Rigid body statics
- Week 6: Rigid body statics
- Week 7: Robotic grasping and fixturing
- Week 8: Robotic grasping and fixturing
- Week 9: Other quasistatic manipulation

Part III Robotic Mobility: “how to make robots move around”

- Week 10: Control and dynamics
- Week 11: Control and dynamics
- Week 12: Robotic walking and running
- Week 13: Robotic walking and running

Statement of Objectives/Outcomes:

On completion of this course, students will be able to:

CO1 - Explain mathematical tools for describing robotic motion.

CO2 - Understand robot statics and dynamics.

CO3 - Explain how to plan for object grasping and manipulation with robots.

CO4 - Explain how to realize robotic locomotion.

CO5 - Implement software for robot planning and control.

Textbook(s):

No required text. References will be announced in case needed.

Reference Books/Materials:

M. T. Mason, *Mechanics of Robotic Manipulation*, MIT Press, Cambridge, MA, USA, 2001.
K. M. Lynch and F. C. Park, *Modern Robotics*, Cambridge Univ. Press, Cambridge, U.K, 2017.

Relationship of Course to Program Outcomes:

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme:

Homework or laboratory assignments	40%
Term project 1 or Midterm examination	30%
Final project	30%